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FROM

EXPERIMENT STATIONS

SEASON 1954-55

KENYA

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For the 1954-55 season and subsequently the Progress Reports published in this series will be confined to those from territories in which members of the Corporation's staff are working. For 1954-55 the list will be:—

Cotton Research Station, Namulonge,
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West Indies,
Survey of Reports.

KENYA
NYANZA PROVINCE
PROGRESS REPORT FOR THE SEASON 1954-55

BY

M. S. HASTIE.

Introduction.

During the past season water supplies at Homa Bay and Kibos have been improved. An office, laboratory, store and insectary have been built for the Government entomologist who has been appointed to work at Kibos, principally on cotton. An electric generator has been installed to provide power and light for the station.

It has been decided to expand Bungoma township, and most of the land of the cotton substation there will be absorbed for housing sites. The cotton work in North Nyanza will be transferred to a new cotton substation to be established at Busia. Clearing of bush will start as soon as the limits of the site are fixed. It is hoped that 50 acres can be acquired. Eventually Bungoma will be reduced to about 10 acres.

From 1st July 1955 Kenya has had its own Cotton Lint & Seed Marketing Board. Cotton Committees in Nyanza and Coast Provinces will administer funds made available by the Board for projects which are expected to benefit the cotton industry and cotton growers. About £740,000 will be kept in reserve by the Board as a price stabilisation fund for the growers in Nyanza Province.

Visits to the Cotton Experiment Station, Kibos, and the Nyanza cotton areas were made during the season by Dr. J. B. Hutchinson, Director of the Cotton Research Station, Namulonge, Uganda, and Mr. R. J. M. Swynnerton, Deputy Director of Agriculture, Dr. C. C. Webster, Chief Research Officer, and Dr. le Pelley, Senior Entomologist, of the Kenya Department of Agriculture.

Table 1.
Rainfall in Inches.

	North Nyanza		*C. Nyanza*	*South Nyanza*	
	Itesio	*Bungoma*	*Kibos*	*Homa Bay*	
	Leprosarium	*Cotton substation*	*Main station*	*Ginnery*	*Cotton substation*
Apr. '54	12·97	9·39	11·95	8·10	11·12
May	13·11	11·72	10·73	8·15	9·73
June	4·44	4·73	3·00	3·00	3·30
July	6·54	5·03	5·56	2·50	2·93
Aug.	4·83	5·33	5·01	5·65	5·52
Sept.	4·26	4·86	2·07	1·70	3·99
Oct.	4·67	5·61	2·83	1·35	4·74
Nov.	2·77	2·72	1·50	0·35	2·56
Dec.	3·64	6·56	3·74	2·15	3·73
Jan. '55	2·68	3·41	3·41	—	0·61
Feb.	4·51	0·94	3·99	—	0·97
Mar.	3·61	2·24	5·48	4·20	2·34
	68·03	62·54	59·27	37·15	51·54

Rainfall during the 1954-55 season was most satisfactory where the cotton crop was planted early, but a long dry spell during the latter part of July compelled many growers to wait until August/September before planting. This was particularly the case in North Nyanza. The short rains which generally occur in October/November failed to materialise in most places and where rain was experienced it came mainly in the form of storms which did little good. Unexpected rain fell during January/March, which is normally picking time, bringing much of the late cotton to maturity in Central and North Nyanza. Rain which fell after this period caused considerable damage to the late opened bolls.

Cotton Crop.

A comparison of the 1954-55 crop with that of the previous season is given in Table 2.

Table 2.

Cotton Production in Nyanza by Ginneries.
1953-54 and 1954-55.

Ginnery	1953-54			1954-55		
	Acreage	*Total 400 lb. bales*	*% BR*	*Acreage*	*Total 400 lb. bales*	*% BR*
S. Nyanza	14,000			14,500		
Homa Bay		726	36·6		1,814	19·6
C. Nyanza	30,000			28,000		
Kibos		322	37·9		243	26·7
Ndere		1,399	11·3		1,945	9·9
Ukwamba		3,464	4·8		3,384	6·3
N. Nyanza	20,000			30,000		
Nambare		2,902	3·4		2,325	5·4
Malakisi		1,488	7·1		1,075	4·7
	64,000	10,301	8·9	72,500	10,786	9·3

Ginning of the crop had not yet been completed at Nambare and the 1954-55 figures for this ginnery are approximations.

Buying started in South Nyanza on 13th December and elsewhere on 3rd January to conform with Uganda along the border. The prices paid to growers were 60 cents per lb. of seed cotton for A grade and 23 cents for B grade as compared with 50 cents and 17 cents respectively in 1953-54.

As in the previous season all cotton seed distributed to growers was dusted with Perenox, with the exception of 60 tons in the Nambare area. The amount of land under cotton in Central and South Nyanza remained much the same as in the 1953-54 season but in North Nyanza there was a 50% increase. In this area, particularly along the Uganda

border, dry weather conditions in October/November for late plantings, which constituted the bulk of the crop, and a heavy *Lygus* infestation drastically reduced yields and more than offset the increased acreage planted to cotton. In South Nyanza, Uk48 was planted throughout for the first time and a record crop for the district was obtained. The new variety, early planting and good rains, with a drop in insect pests, all contributed to increase the crop. The drop in production in the Kibos and Ukwamba cotton areas of Central Nyanza was largely due to the relative failure of the short rains. The reliability of the short rains is not good, and, with the majority of growers planting after the main rains, there will always be doubt about the last 2-3,000 bales.

Cotton buying in Central and North Nyanza had to be extended until 30th April. This was due to the very late rains in the first four months of 1955. Towards the end of March and during early April rain storms caused considerable damage to the late crop.

Disease.

Bacterial Blight.

With the continued use of Perenox, bacterial blight (*Xanthomonas malvacearum*) continued to be found mainly in the angular leaf spot phase and as external boll disease. Some places in the Nambare area of North Nyanza did show considerable damage from this disease in the blackarm phase but this was probably due to the release of 60 tons of undusted seed late in the planting season. Elsewhere, fairly satisfactory control of this disease was obtained.

Results of Experiments.

Thinning Experiment—Kibos.

It has been the standard practice in Nyanza cotton areas to advocate early thinning to 2 plants per hole, and this experiment was designed to test the validity of this practice. The trial was planted on 25th March. Early thinning was carried out on 15th April and late thinning one month later. In addition to date of thinning, the number of plants left per hole was varied. Results are given in Table 3.

Table 3.
Thinning Experiment, Kibos.

	Lb./acre seed cotton	
No. of plants/hole	*Early thinning*	*Late thinning*
1	588	765
2	591	1,027
3	602	502

Standard error 168·5. Differences not significant. 4 randomised blocks with plots 18 ft. × 40 ft. Tied bench ridges with S47 cotton planted 3 ft. × 2 ft.

This experiment was planted on a very fertile piece of ground. Regardless of date of thinning or the number of plants per hole, growth was extremely rank, some plants growing to 7 feet. Stainer incidence was very high and the damage caused by them was considerable. A high proportion of the yield was B grade cotton. There was no significant difference between treatments.

Date of Planting Experiment.

Usually the main rains break at the end of March or early April and end in late May or early June. This experiment was designed to consider the effects on cotton planted just before, during, and after these rains.

Table 4.

Date of Planting Experiment, Kibos.

Date of planting	*Lb./acre seed cotton*
Early March	1,006
Early April	604
Early May	477
Early June	268
Sig. Diff. (P = 0·05)	256·33
S.E.	80·26

4 randomised blocks with plots 24 ft. × 40 ft. Tied bench ridges with S47 cotton planted 3 ft. × 2 ft.

The results of this trial clearly indicate that in the 1954-55 season planting before and early in the rains produced considerably larger yields than planting after the main rains. The March plots were significantly better than all others, while April plantings significantly outyielded June.

Variety Trials.

At Kibos and Homa Bay variety trials were laid out to compare Tanganyika commercial varieties with S47.

In both trials growth was very good. No variety significantly outyielded the others but Uk53 gave the best performance at both places. S47 matured earlier than the Ukiriguru varieties. More than 25% of the seed cotton picked in these trials was stained.

TABLE 5.

VARIETY TRIALS, KIBOS AND HOMA BAY.
(Yields of seed cotton in lb./acre).

Variety	*Kibos*	*Homa Bay*
S47	816	1,067
Uk48	859	1,027
Uk51	862	1,150
Uk53	986	1,157
Significance	NS	NS

4 × 4 Latin squares with plots 12 ft. × 40 ft. at Kibos and 18 ft. × 40 ft. at Homa Bay. Spacing 3 ft. × 2 ft. on tied bench ridges. Planted in April.

Manuring and Cultivation Trials.

Trials to compare flat cultivation, single tied ridges and bench tied ridges, with and without manure and mulch, were laid out at Kibos, Bungoma and Homa Bay. Manure at 10 tons per acre was applied before planting. Mulch was maintained throughout the season.

A 3 × 2 × 2 design was used with plots 24 ft. × 48 ft. S47 was planted in May at Kibos and in late July at Bungoma. At Homa Bay Uk48 was planted early in April. Yields of seed cotton per acre are given in Tables 6, 7 and 8. In each case there were three replications.

TABLE 6.

MANURING AND CULTIVATION EXPERIMENT, KIBOS.
(Yields of seed cotton in lb./acre).

	Flat	*Tie ridged*	*Benched and tied*
Mean yield	332·4	415·5	339·9
Main effects:			
Manure	+107·9	+ 25·2	+ 69·3
Mulch	−129·2	−135·5	−276·5
Interaction:			
Manure × mulch	+169·3	+238·7	− 92·9

MAIN EFFECTS:

Standard error = 29·32. Significant difference P = 0·05 = 61·36.

Unfortunately, the fertility of the field used at Kibos for this trial was patchy and there was a tendency for waterlogging in parts. In the mulched plots, the plant foliage was somewhat yellow in colour and growth and yield were depressed. Because of the unsatisfactory conditions under which the experiment was grown, it will be repeated in the 1955-56 season.

TABLE 7.
MANURING AND CULTIVATION EXPERIMENT, HOMA BAY.
(Yields of seed cotton in lb./acre).

	Flat	*Tie ridged*	*Benched and tied*
Mean yield	513·8	593·8	623·7
Main effects:			
Manure	+ 69·7	+130·4	+ 72·1
Mulch	−173·7	−153·2	−161·9
Interaction:			
Manure × mulch	+ 45·3	− 36·6	+ 39·8

MAIN EFFECTS:
Standard error = 27·16. Significant difference P = 0·05 = 56·84.

Growth was very good except in those plots which had been mulched. As at Kibos, mulch depressed growth and the foliage was very light in colour. Yield in the mulched plots was significantly lower than in the controls.

Yields were increased significantly by manuring.

TABLE 8.
MANURING AND CULTIVATION TRIAL, BUNGOMA.
(Yields of seed cotton in lb./acre).

	Flat	*Tie ridged*	*Benched and tied*
Mean yield	80·8	57·3	72·4
Main effects:			
Manure	+ 28·9	+43·3	+24·2
Mulch	− 10·0	−31·1	+ 4·5
Interaction:			
Manure × mulch	− 29·3	+12·6	+48·6

MAIN EFFECTS:
Standard error = 7·88. Significant difference P = 0·05 = 16·5.

At Bungoma mulch depressed growth and gave a yellowish foliage as at Kibos and Homa Bay, but owing to poor growth throughout the experiment and the patchy fertility of the field the full effect was not evident in the yield figures. Manuring had a beneficial effect that was significant at the 5% level. The experiment will be repeated in the 1955-56 season but will be planted much earlier.

In none of the trials was there any important difference between the three cultivation methods.

At Bungoma, which is in an area that is known to be phosphate deficient, a 3^3 trial was laid down to compare 3 levels of phosphate (0, 100, and 200 lb. per acre superphosphate), 3 levels of nitrogen (0, 100, and 200 lb. per acre sulphate of ammonia), and three levels of

cattle manure (0, 5 and 10 tons per acre). The manure was applied before planting and the fertilisers after germination. The plots, 24 ft. × 48 ft. in size, were bench ridged and tied. The experiment was planted with S47 late in July. Yield data are given in Table 9.

TABLE 9.

MANURE AND FERTILISER EXPERIMENT, BUNGOMA.
(Main effects in lb./acre seed cotton).

Phosphate			*Dung*		
Po	P_1	P_2	Do	D_1	D_2
81·5	99·9	121·0	69·7	101·6	131·1

Standard error = 11·17. Significant difference P = 0·05 = 22·8.

Growth was poor on the whole. Significant increases in yield were obtained with both phosphate and cattle manure, the increases being approximately linear in each case. There was no appreciable response to nitrogen. Interactions were quite unimportant.

ENTOMOLOGY.

BY

T. J. CROWE.

(This report is included by courtesy of the Kenya Government.)

Survey of Pests.

During the season much time was spent in making fortnightly visits to the cotton growing areas to gain familiarity with the diverse conditions under which the crop is grown. Routine assessments were made on African grown plots of the level of *Lygus* attack, using the leaf-grade method. Estimates were made of stainer populations. Collections of shed bolls and flared squares were made from marked rows. The average large boll (normal and mummified) number per plant was estimated regularly to follow the progress of crop production. Over 200 shambas were visited when the cotton on them was nearly ready to pick and samples of large green bolls were collected and examined for evidence of bug or bollworm damage. As well as these counts qualitative observations were made on other plots.

From these observations it became apparent that there are three zones of Nyanza Province throughout each of which the pest complex is broadly similar: —

(1) The Luo-Suba area fringing Lake Victoria and extending from the Tanganyika border almost to Uganda. This area is served by Homa Bay and Kibos ginneries.

(2) The Western Division of North Nyanza—i.e. the area next to the Uganda border. This is served by Malakisi and Nambare ginneries.

(3) A small but highly productive area between these larger ones roughly corresponding with Samia Location of Central Nyanza and chiefly served by Ukwamba ginnery.

Luo-Suba.—Dysdercus populations were fairly large (up to 6,000 adults per acre). Populations fluctuated widely but on average they were greater at the beginning of the season and at the end. It seems likely that the initial migration was concentrated in the early planted fields. Later it dispersed as a greater acreage become attractive and after that there was a build-up of numbers everywhere. *D. superstitiosus* (44·6%) and *D. nigrofasciatus* (53·2%) were the dominant species. Occasional specimens of *D. fasciatus* and *D. cardinalis* were taken.

Apart from a few kapoks planted as ornamentals there are no tree hosts of stainers in this region. The alternative hosts are all herbs or small shrubs, mostly species of *Hibiscus* and *Abutilon* growing as weeds on cultivated or recently cultivated ground. Judging by the percentage of nymphs in the population more stainer breeding took place on wild hosts than on the cotton. The poor vegetative growth of the average peasant crop probably offered inadequate ground shade, making the soil unattractive for egg laying.

Lygus damage was slight until the beginning of July. From then on it increased to a peak at the beginning of September. A leaf-grade of 1·79 (maximum = 4) was the highest recorded. Shed collection was, unavoidably, not frequent enough to get a complete picture of causes of shedding. Many buds, particularly the very small ones, were undoubtedly overlooked. Of the sheds collected throughout the season, 23% had bug punctures and 14% were damaged by bollworm. The bollworm attack (chiefly *Heliothis armigera*) was mostly at the beginning of the season, *Lygus* causing greater loss towards the end.

Counts and examination of large bolls just before harvest showed that 42·2% of the locules were partly or wholly stained by *Nematospora*. Only 1·4% of bolls had any evidence of bollworm damage; 1·2% had living bollworms, chiefly *Platyedra gossypiella*. The average number of ripe bolls per plant fell progressively from 8·4 on April planted cotton to 3·1 in August planted cotton, giving additional evidence of the importance of early planting in this area. About 14% of these large bolls were a total loss due to mummification; the proportion was roughly constant regardless of the month of planting. There is strong circumstantial evidence that stainers are at least a contributory cause of the mummification of large bolls.

North Nyanza.—Here stainer populations were much smaller. On many plots the numbers were negligible throughout the season. On others there was a build-up in December and January, 2,500 per acre being the highest figure recorded. The *Lygus* attack was more severe than in the Luo-Suba area. A leaf-grade of 3·12 was recorded on one plot in mid September. Leaf damage in many places was intensified by hail. From November onwards *Lygus* populations declined. Some plots recovered well and produced an excellent crop. Many developed blackarm attack more severely than in other parts of the Province or got bad second rains. In either case a poor crop was produced. Examination of large green bolls showed that 4·2% had some degree of bollworm damage. 3·1% had living bollworms present; almost all were *Platyedra gossypiella.* 29·9% of locules were in some degree stained by *Nematospora.*

A final visit was paid to North Nyanza in April to check that all cotton had been uprooted. One shamba was found still only partly cleared. Examination of a 100-boll sample revealed 27 pink bollworms. Every locule was stained or damaged or both.

Samia.—Here the pest complex closely resembled that of the Luo-Suba zone but the populations of all species were lower. The maximum leaf-grade recorded was 1·2. Only 16·1% of locules showed any degree of stainer damage and only 1·1% of bolls had any bollworm damage. June planted cotton had nearly the same average ripe boll number (about 6) as in the Luo-Suba area, but the crop was much better in quantity and quality since the amount of staining was less and only a very small number of large bolls were mummified.

Status of the Pests.

Cotton Stainers (*Dysdercus spp.*).—*D. superstitiosus* and *D. nigrofasciatus* are major pests in the Luo-Suba area. It appears that they are usually responsible for the greater part of the stained cotton bought every year by Kibos and Homa Bay ginneries. In 1953-54, when the fields were described as "crawling with stainers", stained cotton formed 39% of the cotton purchased, a record for the Province. In December 1947 when F. R. Parnell visited Nyanza he remarked on the very small stainer populations and was told that this was quite exceptional. That year the figure for stained cotton dropped to 10% —the lowest recorded from these ginneries. *D. cardinalis* has always been described as rare, and was so this season. *D. fasciatus* is common only in the vicinity of ginneries and occasionally of buying posts. It is not a pest of the growing crop.

Lygus spp.—This year *Lygus* caused moderate damage in the Luo-Suba area and severe damage in North Nyanza. This is not always so. In the previous season parts of North Nyanza were described as having escaped *Lygus* damage. The effect of this insect on yield will be studied in different parts of the Province next season, using insecticides. But it will obviously be many years before its importance can be accurately estimated.

American Bollworm (*Heliothis armigera*).—This bollworm was probably only a minor pest of timely planted cotton this season. It caused a lot of shedding early in the season but at a time when the plants were best able to stand it. It is considered to have done much more damage in other years however. Damage to large bolls was negligible.

Pink Bollworm (*Platyedra gossypiella*).—This has never been considered a serious pest. However, the large number found in the "out-of-season" bolls mentioned above suggested that the present close season* is giving adequate control, but to make it any shorter would be most unwise. None of the specimens bred out during the year had a pupal diapause. About a quarter were parasitised by *Microbracon kirkpatrickii.*

Spiny Bollworm (*Earias spp.*).—This bollworm has never been reported causing serious damage. It was found boring into young shoots early in the season but the plants recovered quickly. It was responsible for some shedding but was rare in large bolls.

Jassid (*Empoasca spp.*).—There was a light jassid attack and damage was noticeable in Central and South Nyanza at the end of the season. Both Uk48 and S47 showed adequate resistance. At least three jassid species are present but they have not yet been authoritatively identified.

Other Pests.—The cotton aphid (*Aphis gossypii*) was common but did little damage. *Helopeltis* caused slight and highly localized damage this season. The false codling moth (*Argyroploce leucotreta*) was found occasionally on both young and old cotton, but never in quantity. Unless there is a major change in cultivation practice none of these species seems likely to become a serious pest.

*The effective close season lasts about three months, varying slightly from district to district and from year to year.

Experimental Work.

The experimental programme has two objects. The first is to estimate the potential cotton yield in the various parts of Nyanza when optimum pest control is achieved. This entails finding an experimental design, simple enough to be repeated at many different sites, that will give complete control of the various pests for different periods. The second is to produce a schedule of insecticide application feasible and economic on peasant grown cotton. Though ideally the pursuit of the second should wait on the attainment of the first, it is necessary, owing to the urgency of the problem, to pursue both simultaneously.

Potential Yield.—A "single-row" experiment using McKinlay's design was laid down at Kibos. The results are shown in Table 10.

Table 10.

Potential Yield Experiment, Kibos.

Treatment		*Lb./acre seed cotton*		
		AR	*BR*	*Total*
August-September	Spraying	742	598	1340
September—October	Spraying	564	398	962
August-October	Spraying	557	363	920
Control		411	406	817

S.E. = 71·1. Sig. diff. (P = 0·05) = 246·1.
Spray. 0·1% DDT at weekly intervals. Design. Latin square.
Plot size. A single row, 44 ft. long. Planting date. 26th April.

The experiment failed in its main object for two reasons. Weekly spraying gave excellent bollworm control but, though *Lygus* damage was reduced, the leaf-grade on treated plots never fell below 1·1. The second cause of failure was the large amount of stainer damage. Laboratory tests at Namulonge had shown that DDT is repellent to stainers as well as *Lygus*. Under field conditions, however, this repellence was no longer perceptible 48 hours after spraying. Moreover, sprayed plants were never completely free from stainers even during this period. The object of the experiment would still have been achieved if the stainers had only stained the lint. But so high a proportion of large bolls were a total loss owing to mummification that potential yield could still be only roughly estimated. A conservative estimate of potential yield calculated from the proportion of mummified locules on large bolls was 1,510 lb./acre.

It is hoped to achieve complete control of stainers and *Lygus* during the coming season, using a modified version of this experiment.

Field Trials.—The object of the empirical field trials was to find at which period during the growth of the crop it was most profitable to give protection against pests. Each period lasted approximately 50 days, during which there were five applications of 1 lb. DDT plus 0·3 lb. gamma BHC per acre as a high volume spray at 10 day intervals. Four trials were laid down on the Kano Plain, since it was correctly suspected that pest incidence was much higher on the experimental station than on African plots. The furthest trial was about 30 miles from Kibos. Plots were 1/7 acre, adjacent plots being separated by 10 rows of unsprayed cotton. There was no replication at each site. All were planted about the end of April. Yields are tabulated in Table 11.

TABLE 11.
FIELD SPRAYING TRIALS, KANO PLAIN.

Site	*Protection Period*	*Lb./acre seed cotton*		
		AR	*BR*	*Total*
Awasi	August 1st-September 20th	373	107	480
	September 20th-October 30th	395	113	508
	October 20th-December 10th	335	127	462
	Control	407	95	502
Rabuor	August 1st-September 20th	529	123	652
	September 10th-October 30th	240	63	303
	October 20th-December 10th	232	85	317
	Control	220	81	301
Nyakach	August 1st-September 20th	784	203	987
	September 10th-October 30th	463	138	601
	October 20th-December 10th	330	81	411
	Control	329	102	431
Kajulu	August 1st-September 20th	809	270	1,079
	September 10th-October 30th	516	144	660
	October 20th-December 10th	343	144	487
	Control	299	130	429

Unfortunately, no rainfall records were kept at these plots, though the Kajulu site was near enough to the main station for the Kibos figures to be valid. The failure at Awasi appears to be due at least in part to a highly atypical rainfall distribution. The sharp fall at Rabuor was certainly due to the failure of the second rains, causing very early senescence.

These experiments were essentially observation plots. This was unavoidable, since no reasonably compact, replicated design was known which would give adequate stainer, *Lygus* and bollworm control without inter-plot interference. Conclusions are therefore only tentative, but some indication is offered of the potential yield in this area, the approximate period to be covered by insecticidal application and the importance of rainfall observations on district plots.

Since it is apparent that in the Nyanza cotton area there is very rarely sufficient water for high volume spraying to be contemplated, a trial was laid down at Kibos to compare the high volume spray used in the district plots with a low volume (8-10 gallons per acre) spray of the same weight of insecticide and two standard cotton dusts (3% gamma BHC/10% DDT and 3% gamma BHC/5% DDT) at 20 lb./acre. All treatments were applied five times at 10 day intervals beginning on August 10th. Unsprayed plots were not included since it was assumed that *Lygus* movement would give misleading yield figures.

3 : 10 : 0 cotton dust was just significantly ($P = 0{\cdot}05$) better than the other formulations, which did not differ significantly; most experiments will be done with dusts in the coming season.

In laboratory tests BHC and Malathion showed some promise as baits for *Dysdercus,* but it did not prove possible to test them adequately on a field scale.

Received December 1955.

T. BUNCLE AND CO. LTD., ARBROATH.